

**1. Nuclear Power Generation  
- Radiation Hormesis -**

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# Verifying Radiation Hormesis in Laboratory Animals

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## Background

Radiation has long been considered harmful in no matter how small a dose. As a research program on the biological response to low dose radiation conducted mainly by this laboratory is progressing, people have gradually come to recognize that radiation hormesis, which includes the suppression of cancer and aging, is a reproducible phenomenon.

## Purpose

Through a project called "Research on the Biological Response to Low Dose Radiation" conducted with 16 institutions including schools of medicine and pharmacology of certain universities, we sought to verify that radiation hormesis does occur, and attempted to elucidate the mechanism by which it occurs. Lectures and other events are being sponsored to inform the general public and specialists about the research results in order to gain understanding toward hormesis research.

## Principal Results

1. To explain the reasons for the hormetic effect that suppresses lung cancer metastasis, we conducted an experiment in which mice were irradiated with low doses of X-rays (15 cGy), and confirmed an increase in the anti-cancer substances in spleen cells (interleukin-6, which enhances immune activity, and TNF, or tumor necrosis factor- $\alpha$ , which kills cancerous cells). Laboratory animals were used to demonstrate for the first time that the anti-cancer effect is due to enhancement of immune activity by low dose radiation (Figs. 1 and 2).
2. To investigate the hormetic effect that suppresses aging, we conducted an experiment that gave low doses of radiation to model rats which were treated with the specific agent to induce diabetes, a typical degenerative disease. We found that blood sugar dropped to about half that before irradiation, which provided us with a new example showing the hormetic effect that suppresses aging (Fig. 3). The first report on these results was presented at a conference of the \*\*Japan Biochemistry Society (September 1994, Osaka), and was also reported by the newspapers and other media.
3. We sponsored a symposium called "Health Effects of Low-Dose Radiation" mainly for the general public, and a project result presentation meeting mainly for specialists. In this way we informed many people that a phenomenon that can be called radiation hormesis is becoming recognized.

## Future Initiatives

We shall further accelerate research to verify the hormetic effect and elucidate its mechanism. In doing so

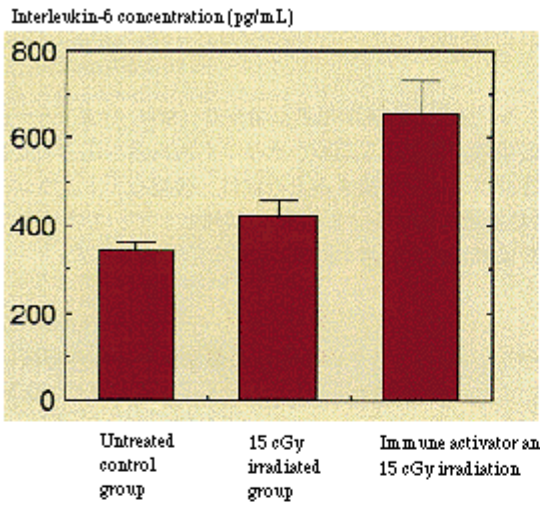
we shall analyze and assess the effects of low dose radiation on living organisms from a broader perspective by not only focusing on hormesis, i.e., the advantageous effects, but also taking into account the workings of the self-defensive (or bioregulatory) functions that act to prevent adverse effects.

**Coordinator**

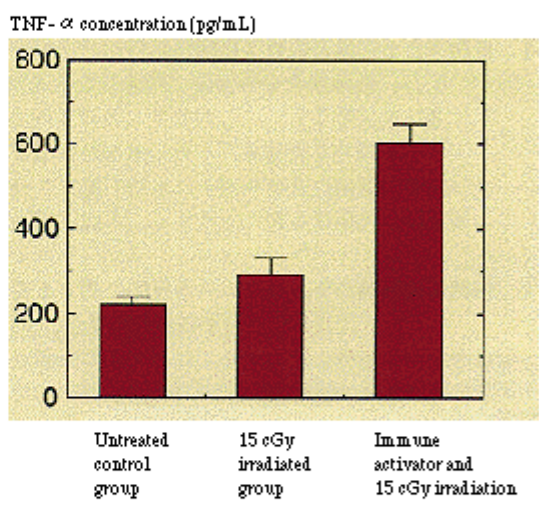
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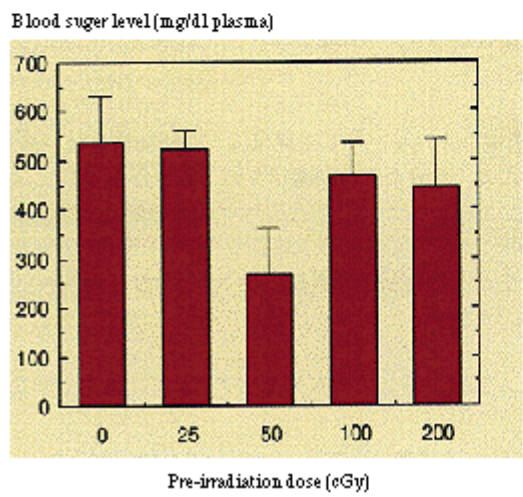
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← Fig. 1 Production of Interleukin-6 in Spleen Cells of Irradiated Mice with Low Dose X-Rays



→ Fig. 2 Production in TNF-α in Spleen Cells of Irradiated Mice with Low Dose X-Rays



← Fig. 3 Blood Sugar Levels of of Irradiated Model Diabetic Rats